Towards Automatic Transformer-based Cloud Classification and Segmentation

Ahan M R*,[1], Roshan Roy*,[1], Ashish Chittora[1], Vaibhav Soni[2]

*equal contribution

[1] BITS Pilani

[2] MANIT Bhopal

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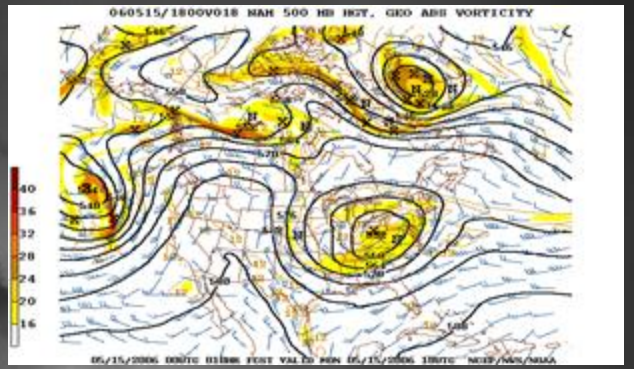
Agenda

- Introduction and Motivation
- Cloud Classification and Segmentation Methodology
- Results
- Outputs Visualized!

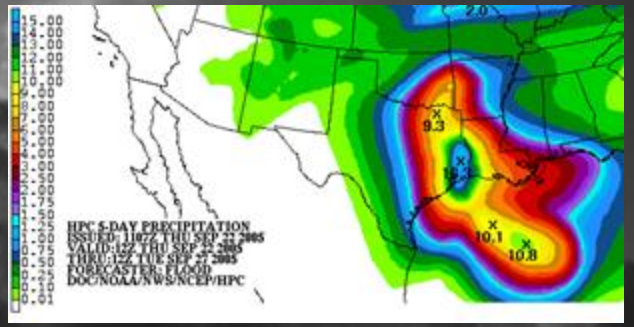
Introduction and Motivation

Solar Energy Power Plants



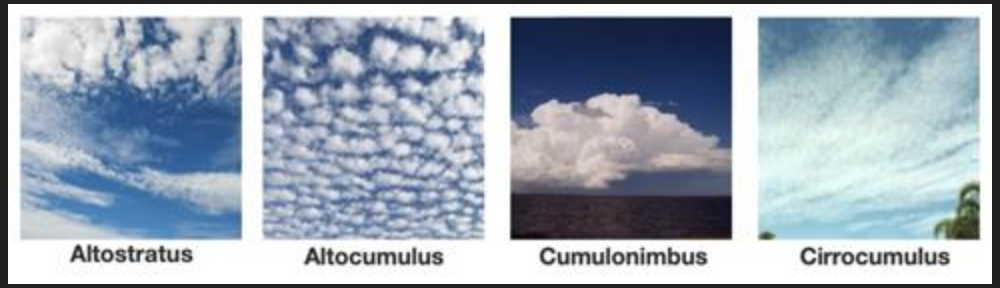
Weather Prediction System

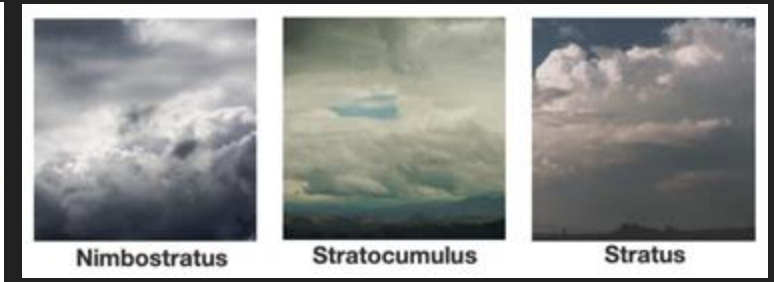
Cloud Cover Estimation



Rainfall Estimation System

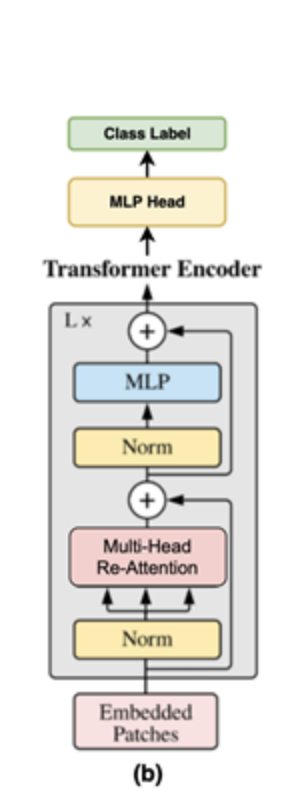
Cloud Classification





Cirrus Cumulus Stratus Nimbus Dataset (CCSN)

Method



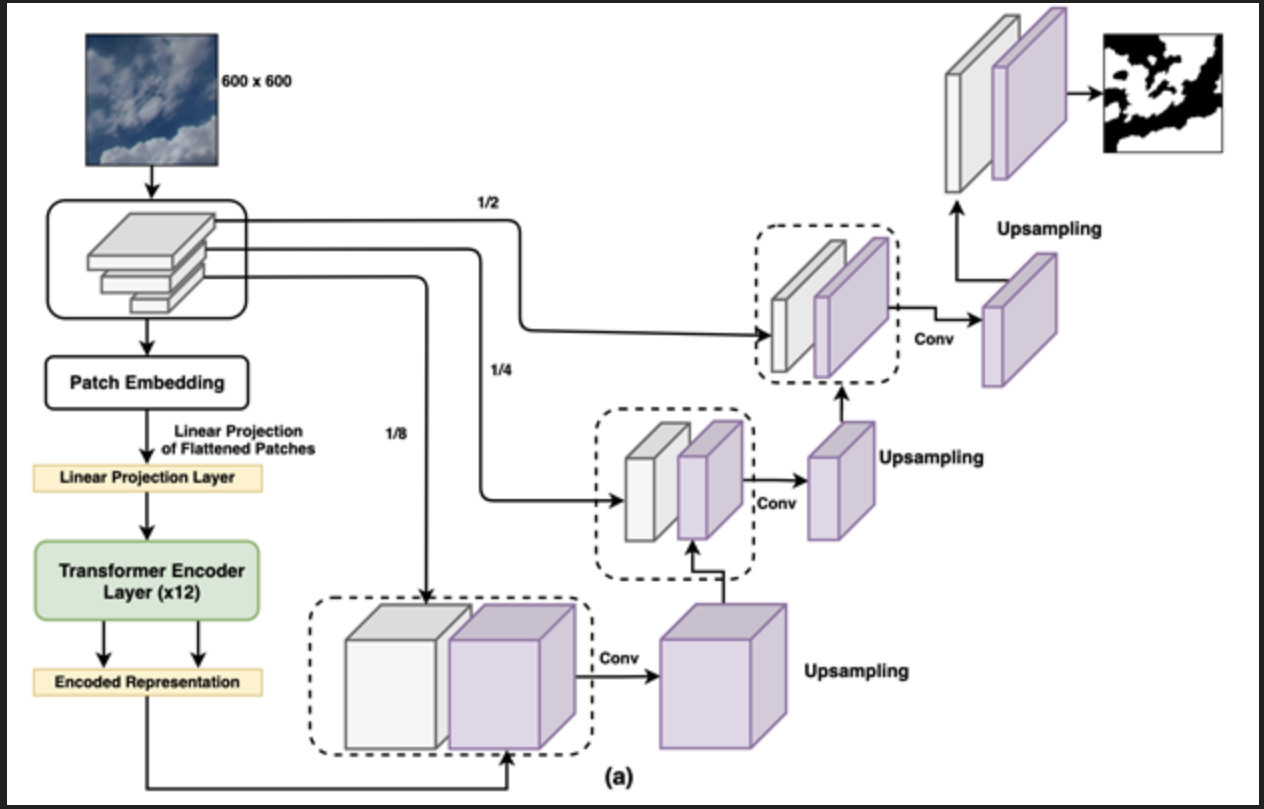
CloudViT Architecture

- Split an image into patches (fixed sizes)
- Flatten the image patches
- Create lower-dimensional linear embeddings from these flattened image patches
- Include positional embeddings
- Feed the sequence as an input to a state-of-the-art transformer encoder
- Pre-train the Vision Transformer model with image labels
- Fine-tune on the downstream dataset for CCSN image classification

Cloud Segmentation

Singapore Whole Sky Imaging Segmentation Database (SWIMSWG)

Method



Cloud U-Net Transformer

Quantitative Results

	Ci	Ac	As	Cu	Cb	Ct	Sc	St	Mean
Accuracy (%)	91.30	94.50	69.29	96.73	91.70	100	68.92	88.14	90.06
F1 score	0.96	0.96	0.59	0.96	0.92	1	0.69	0.82	0.89
Precision	0.92	0.92	1	0.92	0.92	1	0.72	0.9	0.91
Recall	1	1	0.72	1	0.92	1	1	0.75	0.92

CloudViT Classification metrics on CCSN Dataset

Model	mIoU	mDice
U-Net (12)	0.7626	0.8388
DeepLabV3 (3)	0.6281	0.7036
PLS (4)	0.6467	0.6919
CloudUT (Ours)	**0.832**	**0.8927**

Comparison on **SWIMSWG** dataset

	Precision	Recall	F1	Accuracy
ResNet	0.84	0.82	0.81	83.30
CNet (18)	0.84	0.87	0.86	87.62
CloudViT	**0.91**	**0.92**	**0.89**	**90.06**

Comparison on CCSN dataset

Qualitative Results

Input Image

Ground Truth

Predicted Map

Segmentation output on CCSN dataset

Presenters

Roshan Roy

rroshanroy@gmail.com

Ahan M R

ahanmr@gmail.com